BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant: David W. Farchmin
Serial No.: 10/675,608
Filed: September 30, 2003
Title: DISTRIBUTED WIRELESS POSITIONING ENGINE METHOD AND ASSEMBLY
Art Unit: 2688
Examiner: Dai Phuong
Our Ref.: 110003.00057.03AB222

Mail Stop APPEAL
Commissioner for Patents
PO Box 1450
Alexandria VA 22313-1450

APPEAL BRIEF OF APPELLANT

Dear Sir:

Applicant, David Farchmin, has filed a timely Notice of Appeal from the action of the Examiner finally rejecting claims 53-56, 58-70, 72-92, 96, 97 and 100-106 in this application.

i. Real Party in Interest

Rockwell Automation Technologies, Inc., owns all right, title and interest in this application.

ii. Related Appeals and Interferences

None

iii. Status of the Claims

This application contains claims 53-92 and 96-107. Each of claims 53-56, 58-70, 72-81, 87-92, 100-104 and 106 has been finally rejected as being anticipated by US application publication No. 2003/0197643 (hereinafter "Fullerton"). In addition, each of claims 82-86, 96-97 and 105 has been finally rejected as being obvious over Fullerton in view of US patent No. 6,453,168 (hereinafter "McCrady"). Claim 1-52 and 93-95

have been cancelled. Claims 57, 71, 98, 99 and 107 have been objected to as being dependent on rejected base claims. A copy of the claims on Appeal is enclosed in the Appendix.

Claims on appeal here include claims 53-56, 58-70, 72-92, 96, 97 and 100-106.

iv. <u>Status of Amendments</u>

A final rejection of claims 53-56, 58-70, 72-92, 96, 97 and 100-106 was rendered on July 28, 2006 that, among other things, rejected claims 53-56, 58-70, 72-92, 96, 97 and 100-106 as anticipated or obvious over various references. Applicant responded by filing an amendment after final on September 12, 2006. The Examiner responded via Advisory Action dated October 17, 2006 and maintained the final rejection. On September 22, 2006 Applicant filed the Notice of Appeal in this case.

No other amendments were filed after the filing of the Notice of Appeal.

v. <u>Summary of Claimed Subject Matter</u>

Independent claims 53, 82, 87, 96, 100 and 105 are appealed herein.

In general, the independent claims are drawn to methods for estimating the position of a wireless information device (WID) within a space where position information is wirelessly collected, a first subset of position information is used to identify a first position estimate, a second subset of position information is used to identify a second position estimate and then the two estimates are used

Referring to Fig. 6 and accompanying specification at paragraphs 63-65, claim 53 is drawn to a method for determining the location of a wireless information device 30 (see Fig. 1) within a space by (1) obtaining position information indicative of the distances of signal paths between the WID and specific locations (e.g., access points) within the space, (2) using a first sub-set of the position information to identify a first estimate of WID location, (3) using a second sub-set of the position information to identify a second estimate of WID position and (4) using the first and second estimates to identifying a final estimate of the WID location.

Claim 82 is drawn to a method similar to the method of claim 53, albeit where there is a predefined preference for one estimate over another estimate such that if the one estimate is generated, that estimate is rendered accessible and only if the one estimate is not generated is the second estimate rendered accessible. To this end, referring to paragraph 19 of the specification as well as Fig. 6 and paragraphs 63-65, claim 82 is drawn to a method for determining the location of a wireless information device 30 (see Fig. 1) within a space by obtaining position information indicative of the distances of signal paths between the WID and specific locations within the space, (1) attempting to use a first sub-set of the position information to identify a first estimate of WID location, (2) attempting to use a second sub-set of the position information to identify a second estimate of the WID location, (3) when one of the first and second estimates is identified, rendering the one of the first and second estimates accessible by applications requiring WID location and (4) when the one of the first and second estimates is not identified and the other of the first and second estimates is identified, rendering the other of the first and second estimates accessible by applications requiring WID location.

Claim 87 is similar to claim 53 except that, instead of using first and second sets of position information to identify first and second position estimates, first and second position estimating systems (see 60 and 62 in Fig. 1) are used to generate the first and second position estimates. To this end, claim 87 includes the steps of tracking WID location with a first wireless position estimating system to generate a first position estimate, tracking WID location with a second wireless position estimating system to generate a second position estimate and then using the first and second estimates to identifying a final WID position estimate.

Claim 96 is drawn to a system wherein a position estimate is generated along with a confidence factor that indicates the likelihood that the estimate is accurate (see the third sentence of paragraph 13 of the specification), the confidence factor is compared to a threshold requirement, when the confidence factor meets the requirement, the estimate is rendered accessible and when the confidence factor does

not meet the threshold requirement, a different estimating process is performed. In this regard see Fig. 12 and paragraph 94 of the present specification.

Claim 100 is similar to claim 53 except that, instead of using first and second position information sets to identify first and second position estimates, first and second position estimating programs (see paragraph 84) are used to generate the first and second estimates. To this end see paragraphs 60-62 and Fig. 5 as well as paragraph 84 of the present specification that describe a method for estimating WID position by (1) generating a first WID position estimate via a first estimating program, (2) generating a second WID position estimate via a second estimating program and (3) using the first and second estimates to identify a final WID position estimate.

Claim 105 is drawn to a method wherein at least two position estimates are generated and a determination is made as to whether or not any of the estimates is sufficiently accurate and, where at least one of the estimates is sufficiently accurate, the most accurate of the estimates is rendered accessible and if none of the estimates is sufficiently accurate, another function is performed. This claim is supported in the specification at paragraphs 87 through 89 as well as by Fig. 13.

vi. <u>Grounds of Rejection to be Reviewed on Appeal</u>

1. Claims 53-56, 58-70, 72-81, 87-92, 100-104 and 106 have been held anticipated by Fullerton.

2. Claims 82-86, 96, 97 and 105 have been held obvious over Fullerton in view of McCrady.

vii. <u>Argument</u>

The Arguments regarding the grounds of rejection are provided as sections C and D below after some introductory comments regarding the present invention and the prior art cited in the most recent Office Action.

A. **The Present Invention**

The present invention includes methods for accurately determining the position of a wireless information device (WID) (e.g., a palm type device, laptop, etc.) within an environment (e.g., a manufacturing facility). To this end, referring to Fig. 1 below, one way to determine the location of a WID 10 in an environment is to space apart several access points 12, 14, 16, etc., (e.g., wireless signal receivers) in the environment at known locations, cause the WID 10 to transmit signals to the access points 12, 14, 16 and then use the received signals to determine WID location using any of several well known triangulation processes. Thus, for instance, using a typical triangulation process, each received signal can be used to determine the distance (see D1, D2 and D3 in Fig. 1) between the receiving access point and the transmitting WID 10. Using the distances D1, D2 and D3 between WID 10 and three of the access points 12, 14 and 16, respectively, WID location can be determined. In a similar way access points may be used to transmit signals to the WID and the WID may be programmed to use the received signals to determine distances of the access points from the WID and then to generate a WID position estimate by triangulating using the distance estimates.

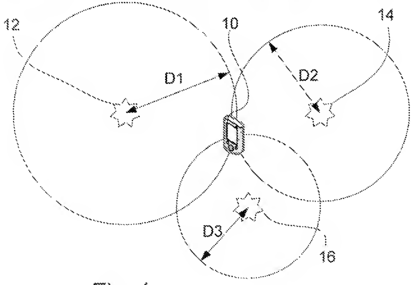

Fig. 1

Referring to Fig. 2, another way to estimate WID position is to use a system where a single stationary access point 20 includes a directional antenna 22 which, as the label implies, can be used to identify the direction from which a signal has been received. In this case, when a WID transmits a signal that is received by the access point, the signal can be used to determine the distance D4 between the WID and the access point. In addition, the directional antenna can be used to determine the direction from which the received signal was received. Using the distance and direction, the WID position can be determined.

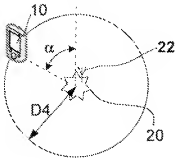

Fig. 2

Still other methods have been developed for estimating WID positions including statistical methods like the methods described in World patent application No. WO/02054813 which was cited in the background section of the present specification.

The present inventors have also recognized that, while there are several different wireless position estimating processes, which process will best estimate WID position may be dependent on characteristics of the space in which the WID operates. To this end, in open spaces that have few if any structures to obstruct wireless transmissions a typical triangulation procedure may optimally and most accurately estimate WID position. In a space that includes many obstructing structures, a statistical estimating process may be optimal. In some dynamic environments such as industrial facilities where large machines and work product are routinely moving, the optimal estimating process may be different at different locations within the industrial space and may in

fact change for specific space locations as machines/work product is moves within the space.

In many applications extremely accurate position estimates are not required 100% of the time. For instance, in the case of wireless use of a laptop computer, if laptop position is off by a few yards for a short time, the system that includes the access points may simply select a less than optimal access point during the short time for communicating with the laptop.

In other applications, however, highly accurate position determinations are required essentially all the time. For instance, in an automated manufacturing plant where a WID is used to monitor and control proximate machines, if a position estimate is off by a few yards a WID user may be presented with information and control tools related to the wrong machine.

In order to increase the accuracy of WID position estimates, the present invention contemplates methods wherein two or more separate position estimating procedures are performed and where the results of the two separate position estimating procedures are used together to generate a final position estimate. Thus, for example, a first WID position estimate may be generated using a triangulation estimating method like the method described above with respect to Fig. 1 while a second WID position estimate may be generated using a statistical analysis method. After the first and second estimates are generated, the first and second estimates are used together to generate the final estimate.

As another example, a first WID position estimate may be generated by triangulating using signals received from a first subset of three access points, a second position estimate may be generated by triangulating using signals received from a second subset of access points that is different than the first subset and then the two estimates may be used together to generate the final estimate.

As still one other example, signals received by three access points may be used to generate a first estimate, signals transmitted to the WID by a second set of three access points may be used by the WID to generate a second position estimate and then the first and second estimates may be used to identify the final position estimate.

In some circumstances it may be likely that one of two or more position estimates is more likely to be accurate than the other of the estimates. For instance, where signals received by first and second access point subsets are used to generate first and second estimates via triangulation, it may be that each of the first and second estimates clearly indicates that a WID is much closer to the first access point subset than to the second access point subset. In this case it will be likely that the first estimate is more accurate than the second estimate. In cases where one estimate is likely more accurate than other estimates, the estimates may be weighted and then combined to generate a final estimate. In the alternative, where one estimate is likely more accurate than other estimates, the likely more accurate estimate may be used as the final estimate and the other estimates may be discarded.

In order to compare different position estimates, in at least some cases the invention contemplates ascribing confidence factors to each estimate generated and then comparing the confidence factors in some fashion to determine how to use the different estimates to generate the final estimate.

In some embodiments position estimating procedures may be performed in sequence when confidence factors associated with existing estimates do not rise above a threshold level. For instance, according to at least some of the inventive methods, when a first position estimating procedure generates a first position estimate and an associated confidence factor, the factor may be compared to a threshold value. When the factor is greater than the threshold value, the estimate may be published for use. However, when the factor is less than the threshold value, the system may be programmed to perform a second position estimating procedure thereby generating a second position estimate and associated confidence factor. This iterative process may continue until an estimate with a high confidence factor is generated and published.

B. Description of the Prior Art

Fullerton (US application publication No. 2003/0197643) teaches six different radio (i.e., WID) position estimating processes. The first and second processes are akin to the process described above with respect to Fig. 2 where a single access point

that includes a directional antenna receives a signal from a mobile radio and the access point uses the received signal to estimate the distance between the access point and the radio and to estimate the angle or direction between the access point and the radio and then uses the distance and direction to determine the radio location. The third, fourth and sixth processes are similar to the triangulation process described above with respect to Fig. 1 where several stationary access points are used to generate distance estimates from a mobile radio to the access points and then the distances are combined to estimate radio position. The fifth embodiment is a hybrid embodiment where several stationary access points and at least one directional antenna are used to generate distance estimates and where the distance estimates and directional information are used to estimate radio position.

As an initial matter it should be noted that, while Fullerton teaches several different position estimating processes, Fullerton always teaches the processes as alternatives to each other and never once even remotely suggests a method where two or more of the separate processes should be performed to generate two estimates and then using the two estimates to identify a final estimate. In effect, Fullerton seems to assume that any one of the disclosed estimates will be sufficiently accurate for any anticipated application and therefore there would be no reason to perform a second estimating process after a first process has been completed.

Referring now to Fullerton's paragraphs 105-112 and to Fig. 11, Fullerton's first position estimating method is described where, when the position of a first impulse radio 1104 is known, the position of a second impulse radio 1108 can be determined by having the first and second radios transmit sequential reference signals there between and using the signal propagation time to estimate the distance between the two radios (see first sentence in paragraph 111). After the radio to radio distance is determined, a directional antenna 1112 on the first radio determines a direction from the first to the second radio (see second sentence in paragraph 111) and then the direction and the distance are used to determine the position of the second radio (see paragraph 112).

Thus, in this first method a distance is determined, a direction/angle is determined and then the distance and angle are used together to generate a single position estimate.

Referring to Fullerton's paragraphs 113 and 114, Fullerton's second estimating process includes a system wherein a universal clock is used to synchronize first and second radios, the time of flight of a signal from a first radio to a second radio is determined, the angle between the radios is determined using a directional antenna and then the angle and the distance values are used to determine the position of the second radio. Thus, in this second method, like the first method, a distance is determined, a direction/angle is determined and then the distance and angle are used together to generate a single position estimate.

Referring to Fullerton's paragraphs 115 through 116 and to Fig. 13, Fullerton's third estimating process includes stationary radios (i.e., access points) 1304 and 1308 and a mobile radio 1312 mounted to a movable object whose position is to be determined. Fullerton teaches that the distances d2 and d3 between radios 1304 and 1312 and radios 1308 and 1312, respectively, can be determined and used to identify the "position" (singular) (see paragraph 116, lines 11-14) of radio 1312 through use of a common triangulation method. Thus, while Fullerton's paragraphs 115 and 116 clearly teach determination of two separate distances, the embodiment only identifies one position estimate by combining the two distances via a common triangulation method.

Referring to Fullerton's paragraph 117, according to the fourth estimating process, Fullerton teaches that a universal clock and distance estimates d1, d2 and d3 in Fig. 13 can be used to estimate position of a mobile radio.

Referring to Fullerton's fifth embodiment described in paragraph 118, a single position estimating process can be used to generate two position estimates and then directional antennas can be used to determine which of the two position estimates is the best estimate. To this end, referring also to Fig. 15, where locations of radios 1504 and 1508 are known (as is distance d1) and the system is attempting to determine the location of radio 1512, transmitted and received signals can be used to determine

distances d2 and d3. Fullerton recognizes however that using only distances d1, d2 and d3 to determine the location of radio 1512 results in position ambiguity wherein position can only be narrowed to two locations (see (x3, y3) and (x3', y3') in Fig. 15). Thus, one position estimating process results in two position estimates. Here, Fullerton teaches that the ambiguity can be resolved by using directional information collected via directional antennas as opposed to using the two position estimates themselves.

Referring to paragraph 119 and Fig. 16, according to Fullerton's sixth process, a simple triangulation method can be used to resolve position ambiguity by providing three stationary radios for receiving signals from a mobile radio 1616 where each of the received signals is used to determine a distance between the receiving radio and the mobile radio. The distances between the radios are used to generate a single position estimate for radio 1616.

The balance of the Fullerton specification simply discusses various versions of the embodiments described above.

Referring to McCrady's Fig. 1, McCrady teaches that in many cases where a set of wireless devices 14, 16, 18 and 20 are used to identify the location of a mobile device 12, the optimal subset of the wireless devices to be used to identify the mobile device location will change as the mobile device is moved about within a space. McCrady also teaches that known locations of mobile devices can be used to identify the locations of other mobile devices (i.e., the mobile devices at known locations can be treated as stationary devices for the purpose of determining the location of another mobile device). McCrady further teaches that the optimal subset of mobile devices for determining the location of one mobile device may change as the mobile devices are moved about within a space. Thus, for instance, at a first time when a first mobile device is at a first location, the location of the first mobile device is to be determined and there are five stationary wireless access point devices within transmitting distance of the first mobile device, a subset of three of the stationary devices may be selected as optimal while at a second time when the first mobile device is at the first location and

two other mobile devices are within transmitting distance of the first device, a subset including one of the stationary devices and the two other mobile devices may be selected as optimal.

Moreover, referring to McCrady's col. 4, line 56 through col. 5, line 4 and also to col. 8, lines 4-18, McCrady teaches a ranging sequence for determining the distance between two devices wherein the two devices do not have to be precisely synchronized with respect to time. To this end, McCrady teaches that the distance between a first mobile device and a second device where the location of the second device is known can be determined by the first device transmitting an initial ranging message/signal to the second device and storing the time of signal transmission for subsequent use. When the second device receives the initial ranging message, the second device processes the message and sends a return signal back to the first device that indicates the location of the second device along with a time period (i.e., a processing time period) that indicates the duration between when the second device received the initial ranging message and when the second device transmitted the return signal. When the first device receives the return signal, the first device identifies the reception time, identifies the period between initial ranging message transmission and reception of the return signal as a total communication time, subtracts the processing time period from the total communication time to identify a time of round trip signal flight between the first and second devices and then uses the round trip flight time to determine the distance between the two devices. Where three or more device to device distances are determined, McCrady teaches that a mobile device position estimate can be generated.

Thus, importantly, McCrady only teaches a single method of determining device position and therefore cannot possibly teach a system where two different methods are used to generate two different position estimates where the two estimates are then used to identify a single final estimate.

Also, importantly, while Fullerton teaches several different position estimating processes, Fullerton fails to teach or suggest a method wherein two different processes

are performed to generate two different position estimates and where the two estimates are then used to identify a final position estimate.

C. Claims 53-56, 58-70, 72-81, 87-92, 100-104 and 106 were rejected under 35 USC 102(e) as anticipated by Fullerton (US Application No. 2003/0197643)

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. MPEP § 2131 citing Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. MPEP § 2131 citing Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

With respect to claim 53, claim 53 includes elements that are not expressly or inherently described in Fullerton and therefore the rejection of claim 53 in view of Fullerton should be withdrawn. To this end, claim 53 is written to cover a method wherein (1) a first subset of position information is used to identify a first estimate of WID position, (2) a second subset of position information is used to identify a second estimate of WID position and wherein (3) the first and second estimates are used to identify a final estimate of WID location.

In the final Office Action, the Examiner contends that distance estimates are akin to position estimates. To this end, in the Office Action dated July 28, 2006 at the paragraph numbered "3", the Examiner cites Fullerton's Figs. 11, 12A and 13 as well as paragraphs 38-40 and 115-117 as teaching the steps of using first and second subsets of position information to identify first and second WID position estimates and using the first and second estimates to identify a final position estimate.

Turning to Fullerton's Figs. 11 and 12A and related paragraphs 105 through 111 which corresponds to Fullerton's first and simplest embodiment, that portion of Fullerton describes a system where the position of a mobile radio is determined by estimating a distance between a radio at a known position and the mobile radio, using a directional antenna to determine the angle or direction between the two radios and then using the

angle and the distance estimate to estimate position. Consistent with this understanding see Fullerton's paragraph 112 that states that "Finally, the position (x2, y2) of the object is determined using the distance d and the angular direction ϕ" (emphasis added) and the last sentence in paragraph 14. Paragraphs 38-40 that were also cited by the Examiner are consistent with this first embodiment where one distance and one direction are determined and then used to identify a final position estimate.

Turning to Fullerton's paragraphs 115-117 and Fig. 13, paragraphs 115 and 116 and Fig. 13 describe Fullerton's third embodiment where distances d2 and d3 are determined and used with known radio positions (x1, y1) and (x2, y2) to generate a single position estimate. Consistent with this understanding of Fullerton's third embodiment, Fullerton states that "Finally, in a step 1420, the position (x3, y3) of the object O is calculated from d2, d3, (x1, y1) and (x2, y2) using a triangulation method." (Emphasis added).

Fullerton's paragraph 117 describes Fullerton's fourth embodiment that is similar to the third embodiment wherein three distances d1, d2 and d3 are used via a triangulation process to estimate position of a mobile radio (see last sentence in paragraph 117).

Moreover, in the Response to Argument section that starts of page 16 of the final Office Action the Examiner refers to distances d2 and d3 as positions. Thus, clearly in the final Office Action the Examiner treated distance estimates incorrectly as position estimates.

A distance from a point alone is not a position estimate. If one states that a vehicle is 500 miles from Denver, the distance specification alone does not indicate a position. Similarly, an angle or direction between a first known location and a second location is not a position of the second location. For instance, it is impossible to tell where a vehicle is that is due east of Denver. Instead, as clearly recognized by Fullerton's first and second embodiments, both direction and distance from a known location are required to specify a position. In the above geographic example, if one states that a vehicle is exactly 500 miles due east of Denver, a position is known from the combined distance and direction information.

Because both direction and distance are required to specify position, one of direction and position cannot alone be considered a position estimate. Thus, while Fullerton's first embodiment teaches separately identifying a distance and a direction, the first embodiment clearly only contemplates generating one position estimate and cannot anticipate claim 53. Similarly, while Fullerton's third and fourth embodiments teach separately identifying several distance estimates, each of the third and fourth embodiments alone only contemplates generating one position estimate and cannot anticipate claim 53.

While Fullerton clearly teaches several different position estimating processes, nothing in Fullerton teaches or even remotely suggests that the different estimating processes could be used in parallel or sequentially to generate different estimates or that different position estimates could be combined or used in some fashion to identify a final estimate. Instead, Fullerton treats the estimating methods disclosed as alternative procedures.

To be thorough, Applicant analyzes Fullerton's second, fifth and sixth embodiments here to show why none of those embodiments anticipates claim 53. To this end, Fullerton's second embodiment described at paragraph 113-114 teaches a method similar to Fullerton's first embodiment except that a universal clock is used so that only a one way signal between first and second radios is required to estimate the location of a mobile radio. Here, importantly, like the first embodiment, the second embodiment calls for generating one distance estimate and a direction and using the distance and direction to estimate position. Once again, a distance estimate alone or a direction estimate alone is not a position estimate and claim 53 is not anticipated by this second embodiment.

In Fullerton's fifth embodiment described at paragraphs 118, a single triangulation method using one set of position information is used to identify two different possible positions for a radio (see paragraph 118, lines 7-10 and Fig. 15 where position ambiguity is described). After the two positions are identified, directional antennas are used to obtain additional information which is in turn used to determine which of the two possible positions corresponds to the actual position of the mobile

radio (see paragraph 118, lines 16-22). Thus, instead of identifying first and second position estimates using first and second information subsets, the fifth embodiment uses one information set to generate two different position estimates. After the two different position estimates have been generated, this fifth embodiment requires additional directional antenna data and uses the antenna data, not the position estimates themselves, to identify one of the two estimates as a final estimate. For at least these reasons claim 53 is not anticipated by Fullerton's fifth embodiment.

In Fullerton's sixth embodiment described in paragraph 119, an additional (e.g., a fourth) radio is provided so that a conventional triangulation method using distance estimates as shown in Fig. 16 can be used to estimate position. Here again distance estimates alone are not the same as position estimates and therefore this sixth embodiment does not anticipate claim 53.

In summary, none of Fullerton's embodiments anticipates claim 53 or any of the claims that depend there from.

With respect to the dependent claims, many of the claims that depend from claim 53 include limitations that are not taught or suggested by Fullerton. For example, claim 54 requires, among other things, the step of generating a confidence factor for each of the first and second estimates where the confidence factors are indicative of the accuracy of the first and second estimates. The portion of Fullerton cited in the final Office Action as teaching confidence factors (i.e., paragraph 110) has nothing to do with confidence factors. A confidence factor is a factor that indicates likelihood that an estimate is accurate (see last two sentences in paragraph 13 of the present specification). Fullerton's paragraph 110 describes a correction factor, not a confidence factor.

More specifically, Fullerton's paragraphs 105 through 110 describe Fullerton's first position estimating process wherein a stationary radio transmits an initial signal to a mobile radio, when the mobile radio receives the signal, the mobile radio processes the signal and then transmits a response to the stationary radio and when the stationary radio receives the response, the stationary radio uses the total time between the initial

signal transmission and reception of the return signal to determine the distance between the two radios. Here, the idea is that the signal velocity through air is known and therefore, if the time of signal travel in one direction between the two radios is known, the distance can be determined by multiplying the time of one directional travel by the known signal velocity.

The total time between the initial signal transmission and reception of the return signal includes three distinct periods. The first period is the period for travel from the stationary radio to the mobile radio. In Fullerton this first period is between times t1 and t2 in Fig. 12A. The second period is the period that elapses between the time when the mobile radio receives the initial signal and the time when the mobile radio transmits the return signal (i.e., a processing period). In Fullerton this second period is between times t2 and t3 in Fig. 12A. The third period is the period for travel of the return signal from the mobile radio to the stationary radio. In Fullerton this third period is between times t3 and t4 in Fig. 12A.

If the duration of the second period (i.e., (t3-t2)) is known, the time of one way signal flight between the two radios can be determined by subtracting the processing time (i.e., the second period) from the total time between the initial signal transmission and reception of the return signal (i.e., (t4-t1)) and then dividing the result by 2 (i.e., the result includes the time of flight of both the initial signal and the return signal so the result has to be divided by 2 to get the time of one way signal flight).

Fullerton recognizes that it may be difficult to manufacture processors that have a uniform processing time (t3-t2) and therefore suggests the calibration process described in paragraph 110. To this end, Fullerton suggests a calibration process whereby a person responsible for calibrating the system estimates and specifies the mobile radio processing time (t3-t2) for use by the stationary radio. Next, a mobile radio is positioned at a known distance (e.g., 20 feet) from the location of the stationary radio and the distance estimating process described above is performed to generate a distance estimate. If the distance estimate is different than the actual distance between

the two radios, the estimated processing time (t3-t2) was inaccurate.

Fullerton contemplates two different ways to compensate for an inaccurate estimate (t3-t2). First, Fullerton contemplates simply adjusting distance estimates by the error in the distance estimate that occurred during the commissioning procedure. Second, Fullerton contemplates that the estimated value (t3-t2) can be adjusted until the distance estimating error during the commissioning procedure is eliminated.

Fullerton's correction factor is not related to a position and instead is related to a distance value. An example of how Fullerton's correction factor is applied is instructive here and can help show the difference between Fullerton's distance correction factor and the position confidence factors required by claim 54. In Fullerton, after a commissioning procedure, assume that a distance correction factor is -5 feet and that during a subsequent position estimating process, an initial distance estimate is 25 feet and an angle estimate is 40 degrees. Here, to determine the position of the mobile radio, first, the correction factor is added to the initial distance estimate to generate a corrected distance estimate of 20 feet. Second, the location of the stationary radio, the corrected distance estimate and the estimated angle are used to identify X and Y coordinates of the mobile radio where the X and Y coordinates are a position estimate (see position of radio 1108 in Fig. 11 that are expressed as (x2, y2). Here, the correction factor is completely unrelated to the X and Y coordinates. In fact, the correction factor is "worked into" and reflected in the position estimate so that there is no way to separately identify the correction factor.

In addition, Fullerton's correction factor is simply a factor that is used to correct distance estimates to compensate for an erroneous estimated processing period (t3-t2) and, in many if not all cases, will not reflect true accuracy of the distance estimate. In this regard, assume again that a correction factor is again -5 feet. In addition, assume that at a first time when industrial machines are in a first set of positions and a mobile radio is in a first location 20 feet from an access point, a first initial distance estimate between the access point and the radio is 25 feet. Assume that at a second time when

the industrial machines are in a second set of positions and the mobile radio is again at the first location, a second initial distance estimate is 20 feet due to the fact that the machines obstruct wireless transmissions to a greater degree when the machines are in the second set of positions. Here, the second initial estimate (i.e., 20 feet which is the actual distance between the access point and the radio) is clearly more accurate than the first initial estimate (i.e., 25 feet) and yet the correction factor is still -5 feet in both cases. Thus, regardless of the phrase used to refer to Fullerton's correction factor, the factor is not indicative of the accuracy of the distance estimate and simply is a factor used to compensate for distance errors due to an inaccurate processing time estimate (t3-t2).

For at least these additional reasons claim 54 is not anticipated by Fullerton.

Each of claims 55, 56 and 58 further limit claim 54 and specifically add limitations that are related to the confidence factors. Because Fullerton fails to teach or suggest confidence factors for position estimates, Fullerton cannot possibly teach or suggest these additional limitations to confidence factors.

With respect to claim 65, Applicant notes that each of Figs. 13 and 15 and accompanying specification teaches multiple transceivers that each generate a distance estimate and where the distance estimates are then combined to generate a single location estimate. Here, as in the discussion above with respect to claim 53, distance estimates are not position estimates and Fullerton only generates a single position estimate despite generating multiple distance estimates. Claim 65 requires N-2 position estimates in addition to the first and second position estimates and therefore is novel over Fullerton for this additional reason.

Claim 67 further requires identifying confidence factors that are not contemplated by Fullerton as described above with respect to claim 54.

Regarding claim 87, claim 87 requires, among other things, the steps of (1) tracking WID location with a first wireless position estimating system to generate a first position estimate, (2) tracking WID location with a second wireless position estimating

system to generate a second position estimate and (3) using the first and second estimates to identify a final WID position estimate.

As discussed above with respect to claim 53, Fullerton's distance estimates are not the same as position estimates and Fullerton clearly fails to even remotely suggest a single method in which first and second position estimates are generated. For this reason alone claim 87 is not anticipated by Fullerton.

In addition, while Fullerton teaches different systems for generating different position estimates as shown in Figs. 11, 13, 15 and 16 and as described in Fullerton's specification, Fullerton teaches the different systems as alternatives as opposed to systems that can be used together to perform a single method to generate intermediate position estimates followed by a final estimate. Thus, for this additional reason, claim 87 and claims that depend there from are not anticipated by Fullerton.

Claims that depend from claim 87 include additional distinguishing limitations. To this end, claim 90 requires that the most accurate of the first and second estimate be used as the final estimate. Fullerton fails to teach or suggest the limitations in claim 90 and therefore claim 90 is not anticipated by Fullerton for this additional reason.

Regarding claim 100, claim 100 requires, among other things, the steps of (1) generating a first position estimate via a first estimating program, (2) generating a second position estimate via a second estimating program and (3) using the first and second estimates to identify a final WID position estimate.

As discussed above with respect to claim 53, Fullerton's distance estimates are not the same as position estimates and Fullerton fails to teach or suggest a single method in which first and second position estimates are generated. For this reason alone claim 100 is not anticipated by Fullerton.

In addition, while Fullerton clearly teaches different programs for generating different position estimates, Fullerton teaches the different programs as alternatives as opposed to programs that can be used together to perform a single process to generate intermediate position estimates followed by a final estimate. Thus, for this additional reason claim 100 and claims that depend there from are not anticipated by Fullerton.

Claims that depend from claim 100 include additional distinguishing limitations. To this end, claim 102 requires confidence factors associated with position estimates. Fullerton fails to teach or suggest confidence factors associated with position estimates and therefore claim 102 is novel over Fullerton for this additional reason.

D. Claims 82-86, 96-97 and 105 were rejected under 35 USC 103(a) as obvious over Fullerton (US Application No. 2003/0197643) in view of McCrady (US patent No. 6,453,168)

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. MPEP § 2142. To establish prima fascia obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. MPEP § 2143.03 citing *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). All words in a claim must be considered in judging the patentability of that claim against the prior art. MPEP § 2143.03 citing *In re Wilson*, 242 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an independent claim is non-obvious under 35 USC 103, then any claim depending there from is non-obvious. MPEP § 2143.03 citing *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Fir. 1988).

Referring to claim 82 of the present application, claim 82 includes elements that are not taught or suggested by either of Fullerton or McCrady and therefore the combination of those two references cannot possibly render claim 82 obvious. To this end, claim 82 requires, among other things, attempting to use first and second subsets of position information to identify first and second WID position estimates, rendering the first position estimate accessible to applications when the first estimate is identified and rendering the second position estimate accessible to applications when the first estimate is not identified and when the second estimate is identified. Thus, here, there is a preferred estimate (the first estimate) and the second estimate is only rendered accessible when the first estimate cannot be identified.

As discussed above, Fullerton fails to teach or suggest attempting to generate first and second position estimates. Fullerton teaches a system for identifying the position of an object or a device by identifying a distance of the object from a fixed location and identifying a direction from the fixed location to the object and then using the distance and direction information to identify a single location estimate or by identifying several distances from the object and using the distances to triangulate a single position estimate. A distance alone clearly is not a position estimate. Similarly, a direction alone is not a position estimate.

In addition, Fullerton fails to teach or suggest that one estimate of any type should be preferred to another estimate of any type as required by claim 82 (i.e. one estimate is rendered accessible when identified and the other estimate is only rendered accessible when the one estimate is not identified). In this regard, even if distance and direction estimates in Fullerton were some how construed as being position estimates, Fullerton does not teach or suggest that one of the estimates could be used without the other to determine the position of a device – this is not surprising as, as indicated above, a position has to require both a direction and a distance from a single location (i.e., the position information must be usable to specify X and Y coordinates).

Turning to McCrady, McCrady teaches that in many cases where a set of wireless devices are used to identify the location of a mobile device, the optimal subset of the wireless devices to be used to identify the mobile device location will change as the mobile device is moved about within a space, that known locations of mobile devices can be used to identify the locations of other mobile devices and that the optimal subset of mobile devices for determining the location of one mobile device may change as other mobile devices are moved about within a space. Thus, for instance, at a first time when a first mobile device is at a first location, the location of the first mobile device is to be determined and there are five stationary wireless access point devices within transmitting distance of the first mobile device, a subset of three of the stationary devices may be selected as optimal while at a second time when the first mobile device

is at the first location and two other mobile devices are within transmitting distance of the first device, a subset including one of the stationary devices and the two other mobile devices may be selected as optimal.

The portion (col. 16, lines 28-50) of McCrady cited in the Office Action with respect to claim 82 teaches that, to determine which subset of devices is optimal for determining the location of the first mobile device, the first mobile device first performs a ranging process whereby the first mobile device determines how far away the other devices are within the space. After the ranging process is completed, the first mobile device selects the optimal subset of devices, generally as a function of the distances between the first mobile device and the other devices and then uses a single set of data associated with the optimal device subset to generate a <u>single location estimate</u>.

McCrady's ranging simply roughly determines distances (i.e., within a range – hence the term "ranging") between a first device to be located and other devices in the vicinity of the first device. As described above, <u>a distance or range is not a position estimate</u>.

In addition, McCrady fails to teach a predefined preference between estimates of any type. To this end, even if range values where incorrectly construed as position estimates, McCrady teaches that the optimal set of ranges and associated devices is selected dynamically as a function of the ranges and perhaps other spatial orientations (i.e., two devices may be along the same line of sight – see McCrady's col. 16, lines 44-45). Thus, the claim 82 predefined preferences for the one estimate over the other estimate further distinguishes the claim from McCrady.

For at least the above reasons claim 82 and claims that depend there from are not obvious over Fullerton in view of McCrady.

Claim 83 further requires identifying confidence factors for each of first and second estimates when the first and second estimates are both identified and then identifying the estimate with the highest confidence factor as a final estimate. As described above with respect to claim 54, Fullerton teaches distance correction factors

used in an interpolation process and fails to teach or suggest confidence factors that indicate relative position accuracy. McCrady fails to teach or suggest confidence factors of any kind. For this additional reason Applicant believes claim 83 is distinct over the cited references.

With respect to claim 96, claim 96 requires, among other things, estimating device position using a first estimating program, identifying a confidence factor for the first position estimate, when the confidence factor is high, rendering the estimate accessible and when the confidence factor is low repeating the process using a second position estimating program. As described above, neither Fullerton nor McCrady teach or suggest a process wherein two position estimates are generated in any case. Again, the portions of Fullerton cited in the Office Action that relate to claim 96 teach a distance estimate and a separate direction estimate while McCrady teaches multiple range estimates. Separate direction, distance and range estimates are not position estimates as that phrase is used in claim 96. In addition, neither Fullerton nor McCrady teach or suggest position estimate confidence factors. Moreover, neither of the cited references teaches or suggests a cyclical process whereby different positioning algorithms are performed after a true position estimate has been generated when the estimate is deemed to be unacceptably accurate.

For at least the above reasons Applicant believes that the cited references do not anticipate claim 96 and claims that depend there from.

With respect to claim 105, claim 105 requires, among other things, attempting to identify first and second different position estimates of a device and, when at least one of the estimates is sufficiently accurate, rendering the likely most accurate estimate accessible as a final estimate. As described above, neither Fullerton nor McCrady teach or suggest a process wherein an attempt is made to generate two position estimates. Again, Fullerton teaches a distance estimate and a separate direction estimate while McCrady teaches multiple range estimates. Separate direction, distance and range estimates are not position estimates as that phrase is used in claim 96. In

addition, neither Fullerton nor McCrady teach or suggest determining if an estimate is sufficiently accurate or rendering a likely most accurate estimate accessible.

For at least the above reasons Applicant believes that claim 105 and claims that depend there from are not anticipated by the cited references.

E. Conclusion

The Examiner's grounds for rejecting claims 53-56, 58-70, 72-92, 96, 97 and 100-106 of the present application appear to stem from an incorrect interpretation of the prior art references. Claims 53-56, 58-70, 72-92, 96, 97 and 100-106 clearly distinguish over the cited prior art references, and allowance of all of the pending claims in this application is requested.

Respectfully submitted,

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viii. Claims Appendix

1. (Canceled)

2. (Canceled)

3. (Canceled)

4. (Canceled)

5. (Canceled)

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10. (Canceled)

11. (Canceled)

12. (Canceled)

13. (Canceled)

14. (Canceled)

15. (Canceled)

16. (Canceled)

17. (Canceled)

18. (Canceled)

19. (Canceled)

20. (Canceled)

21. (Canceled)

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23. (Canceled)

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29. (Canceled)

30. (Canceled)

31. (Canceled)

32. (Canceled)

33. (Canceled)

34. (Canceled)

35. (Canceled)

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41. (Canceled)

42. (Canceled)

43. (Canceled)

44. (Canceled)

45. (Canceled)

46. (Canceled)

47. (Canceled)

48. (Canceled)

49. (Canceled)

50. (Canceled)

51. (Canceled)

52. (Canceled)

53. (Original) A method for use with a portable wireless information device (WID) within a space, the WID including a transmitter for transmitting wireless WID signals, the method comprising the steps of:

obtaining position information indicative of the distances of signal paths between the WID and specific locations within the space;

using a first sub-set of the position information to identify a first estimate of WID location;

using a second sub-set of the position information to identify a second estimate of WID position; and

using the first and second estimates to identifying a final estimate of the WID location.

54. (Previously Presented) The method of claim 53 wherein the step of using the first and second estimates includes generating a separate and distinct confidence factor for each of the estimates where the confidence factors are indicative of the accuracy of the estimates.

55. (Original) The method of claim 54 wherein the step of using the first and second estimates further includes identifying the estimate having the highest confidence factor as the final estimate.

56. (Original) The method of claim 54 further including the step of identifying first and second regions within the space that are associated with the first and second information sub-sets and wherein the step of generating confidence factors includes determining relative juxtapositions between the estimates and the first and second regions.

57. (Original) The method of claim 56 wherein the first and second regions include first and second central locations, respectively, and, wherein, the step of determining relative juxtapositions includes comparing the estimated locations to the first and second central locations.

58. (Original) The method of claim 54 wherein the step of using the first and second estimates further includes mathematically combining the first and second estimates to provide a final estimate of WID location as a function of the confidence factors.

59. (Original) The method of claim 53 further including rendering at least one of the estimates accessible to applications requiring WID position estimates.

60. (Original) The method of claim 53 wherein the step of obtaining includes providing a separate wireless signal receiver at each of the specific locations, receiving signals from the WID and using the signals to identify the position information.

61. (Original) The method of claim 60 wherein the position information includes signal strength information and wherein the step of using the signals includes determining the signal strengths.

62. (Original) The method of claim 53 wherein the step of obtaining includes providing a separate wireless signal transmitter at each of the specific locations and at least one receiver within the space, transmitting signals from the transmitters to the WID, identifying the position information via the WID and transmitting the position information from the WID to the at least one receiver.

63. (Original) The method of claim 62 wherein the position information is signal strength information.

64. (Original) The method of claim 53 wherein first and second facility regions are associated with the first and second position information sub-sets and wherein the first and second regions overlap.

65. (Original) The method of claim 53 further including the step of using N-2 additional sub-sets of the position information to identify N-2 additional estimates of WID position wherein the step of using the first and second estimates to identify a final estimate of the WID position includes using a sub-set of the first through Nth estimates to identify a final estimate of the WID location.

66. (Original) The method of claim 65 wherein the subset of estimates includes all of the first through Nth estimates.

67. (Original) The method of claim 66 wherein the step of using the first through Nth estimates includes identifying a confidence factor for each of the N estimates.

68. (Original) The method of claim 67 wherein the step of using the first through Nth estimates further includes identifying the estimate having the highest confidence factor as the final estimate.

69. (Original) The method of claim 67 further including the step of identifying N regions within the space that are associated with the first through Nth information sub-sets and wherein the step of generating confidence factors includes determining relative juxtapositions between the estimates and the first through Nth regions.

70. (Original) The method of claim 69 wherein the step of identifying N regions includes identifying regions such that each location within the space is located within at least two separate regions.

71. (Original) The method of claim 69 wherein the first through Nth regions include first through Nth central locations, respectively, and, wherein, the step of

determining relative juxtapositions includes comparing the estimated positions to the first through Nth central locations.

72. (Original) The method of claim 67 wherein the step of using the first though Nth estimates further includes mathematically combining at least a sub-set of the first through Nth estimates to provide a final estimate of WID location as a function of the confidence factors.

73. (Original) The method of claim 53 wherein the steps of using the first and second sub-sets of position information include providing a single processor running first and second programs to determine the first and second locations, respectively.

74. (Original) The method of claim 53 wherein the steps of using the first and second sub-sets of position information include providing first and second processors running the first and second programs to determine the first and second locations, respectively.

75. (Original) The method of claim 53 further including the step of identifying first and second regions within the space that are associated with the first and second information sub-sets and wherein the first and second regions at least in part overlap.

76. (Original) The method of claim 53 wherein the step of using a first sub-set includes running a first program to estimate WID position and the step of using a second sub-set includes running a second program to estimate WID position.

77. (Original) The method of claim 76 wherein the first and second programs are different.

78. (Original) The method of claim 77 wherein the first and second sub-sets are identical.

79. (Original) The method of claim 77 wherein the first and second sub-sets are different.

80. (Original) The method of claim 76 wherein at least the first program includes at least first and second algorithms that are performed as a function of general WID location.

81. (Original) The method of claim 53 wherein the space is a three dimensional space within an automated facility.

82. (Original) A method for use with a portable wireless information device (WID) within a space, the WID including a transmitter for transmitting wireless WID signals, the method for tracking the position of the WID within the space and comprising the steps of:

obtaining position information indicative of the distances of signal paths between the WID and specific locations within the space;

attempting to use a first sub-set of the position information to identify a first estimate of WID location;

attempting to use a second sub-set of the position information to identify a second estimate of the WID location;

when one of the first and second estimates is identified, rendering the one of the first and second estimates accessible by applications requiring WID location; and

when the one of the first and second estimates is not identified and the other of the first and second estimates is identified, rendering the other of the first and second estimates accessible by applications requiring WID location.

83. (Original) The method of claim 82 further including the step of, when both the first and second estimates are identified, identifying a confidence factor for each of the first and second estimates where the confidence factors are indicative of the accuracy of the estimates and identifying the estimate associated with the greatest confidence factor as a final estimate to be rendered accessible.

84. (Original) The method of claim 82 wherein the position information includes signal strength information.

85. (Original) The method of claim 82 wherein the step of obtaining includes providing a separate wireless signal receiver at each of the specific locations, receiving signals from the WID and using the signals to identify the position information.

86. (Original) The method of claim 82 wherein the step of obtaining includes providing a separate wireless signal transmitter at each of the specific locations, transmitting signals from the transmitters to the WID, identifying the position information

via the WID and transmitting the position information from the WID to the at least a first receiver.

87. (Original) A method for use with a portable wireless information device (WID) within a space, the WID including a transmitter for transmitting wireless WID signals, the method for tracking location of the WID within the space and comprising the steps of:

tracking WID location with a first wireless position estimating system to generate a first position estimate;

tracking WID location with a second wireless position estimating system to generate a second position estimate; and

using the first and second estimates to identifying a final WID position estimate.

88. (Original) The method of claim 87 wherein each of the tracking steps includes providing receivers at spaced apart specific locations within the space, receiving wireless signals transmitted by the WID and determining a location related characteristic of the received signals that is indicative of the distances of signal paths between the WID and specific locations of the receivers, the step of tracking WID location with the first system further including using a sub-set of the location related characteristics to generate the first position estimate and the step of tracking WID location with the second system further including using a sub-set of the location related characteristics to generate the second position estimate.

89. (Original) The method of claim 88 wherein the location related characteristics includes signal strength.

90. (Original) The method of claim 87 wherein the step of using the first and second estimates to identifying a final WID position estimate includes identifying the most accurate estimate of the first and second estimates as the final estimate.

91. (Original) The method of claim 90 wherein the space is an enclosed space within a facility.

92. (Original) The method of claim 87 wherein the first and second estimating systems use different algorithms to estimate WID position.

93. (Canceled)

94. (Canceled)

95. (Canceled)

96. (Original) A method for estimating the position of a wireless information device (WID) within a space, the method comprising the steps of:

a) estimating WID position via a first estimating program;

b) identifying a confidence factor for the WID position estimate;

c) when the confidence factor meets a threshold requirement, rendering the position estimate accessible to other application; and

d) when the confidence factor fails to meet a threshold requirement, repeating steps (a) through (c) with a second estimating program.

97. (Original) The method of claim 96 wherein step (d) is performed for each of a plurality of estimating programs until one of WID position has been estimated at least once via each of the estimating programs and an estimate that meets the threshold requirement has been identified.

98. (Original) The method of claim 97 wherein, after WID position has been estimated via each of the estimating programs, when none of the estimates meets the threshold requirements, the method includes the step of performing another function.

99. (Original) The method of claim 98 wherein the another function includes indicating that WID position is unknown.

100. (Original) A method for estimating the position of a wireless information device (WID) within a space, the method comprising the steps of:

a) generating a first WID position estimate via a first estimating program;

b) generating a second WID position estimate via a second estimating program; and

c) using the first and second estimates to identify a final WID position estimate.

101. (Original) The method of claim 100 wherein the first and second estimating programs are different.

102. (Original) The method of claim 100 further including the step of generating a confidence factor for each of the first and second estimates and wherein the step of using the first and second estimates includes using to confidence factors.

103. (Original) The method of claim 102 wherein the step of using the confidence factors includes mathematically combining the first and second estimates as a function of the confidence factors.

104. (Original) The method of claim 102 wherein the step of using the confidence factors includes the step of selecting the one of the first and second estimates that is associated with the highest confidence factor as the final estimate.

105. (Original) A method for use with a portable wireless information device (WID) within a space, the WID including a transmitter for transmitting wireless WID signals, the method of tracking the position of the WID within the space and comprising the steps of:

obtaining position information indicative of the distances of signal paths between the WID and specific locations within the space;

attempting to use a first sub-set of the position information to identify a first estimate of WID location;

attempting to use a second sub-set of the position information to identify a second estimate of the WID location;

determining if at least one of the estimates is sufficiently accurate;

when at least one of the estimates is sufficiently accurate, rendering the likely most accurate of the estimates accessible as the final estimate; and

when none of the estimates is sufficiently accurate, performing another function.

106. (Previously Presented) The method of claim 105 wherein the step of performing another function includes indicating that the WID position is unknown.

107. (Previously Presented) The method of claim 105 wherein the step of determining if at least one of the estimates is sufficiently accurate includes generating a confidence factor for each of the estimates and comparing the confidence factor to a threshold factor and, when a confidence factor is greater than the threshold factor, determining that the associated estimate is sufficiently accurate.

ix. Evidence Appendix

None

x. Related Proceedings Appendix

None